the egg. Each remains in close contact with its own nucleus, so that there is no possibility of confusing and mistaking them. When the pronuclei come together the asters also come into contact. The origin of the cleavage centrosomes has not yet been satisfactorily determined.

In the prophase of the first cleavage the chromatin is clearly distinguishable into two kinds, oxychromatin and basichromatin; the latter only takes part in forming the chromosomes; the former becomes arranged like beads on the spindle fibers and is apparently drawn to the two poles. It seems to take no part in the formation of the daughter nuclei and probably forms a part of the granular substance of the sphere. All the cleavage centrosomes undergo a metamorphosis similar to that of the polar spindles and in the telephase of each cleavage the poles of the spindle are occupied by a granular sphere frequently as large as the nucleus, or even larger. These spheres, in every case, move to those portions of the cells which lie nearest the polar bodies. In this position they can be recognized through one and, in some cases, two or three subsequent divisions. It results from the fact that after the first two cleavages the sphere substance is differently distributed to the different cells, the entire sphere substance of one generation always going into those cells of the next generation which lie nearest the animal pole. This differential distribution of the spheres has been followed through every cleavage up to the 24-cell stage. As the form of cleavage is perfectly constant it follows that the sphere substance of any generation goes into certain definite cells which have a perfectly constant origin and destiny. This differential distribution of the spheres is not caused by their specific weight, since their movements are the same in whatever position the egg may be placed. It seems to be the result of a form of polarity which, like that of the egg itself, is not the result of gravity.

The centrosomes do not apparently arise from the sphere substance of the previous division, but some distance from it, and the sphere substance itself never divides, but each sphere ultimately grows ragged at its periphery and gradually fades out into the general cytoplasm.

The differential distribution of these spheres and their subsequent conversion into cytoplasm suggests that they may be important factors in the differentiation of the cleavage cells, and if further investigation should establish the fact that they are in part composed of the oxychromatin of the nucleus it would furnish a basis, in fact, for certain well known speculations of DeVries, Weismann and Roux.

Considerations on Cell-lineage and Ancestral Reminiscence, based on a Re-examination of Some Points in the Early Development of Annelids and Polyclades. EDMUND B. WILSON.

THIS paper attempted to reconcile the apparent contradiction in cell-lineage between the annelids and polyclades, and to show that homology and ancestral reminiscence may appear as clearly in the cleavage period as in other stages. In *Leptoplana*, a polyclade, all of the first quartets of micromeres produce ectoblast, as in the annelids or mollusks, while the main mass, if not all, of the mesoblast arises by delamination from the second quartet. The formation of ecto-mesoblast ('larval mesenchyme,' or 'secondary mesoblast') from cells of the second or third quartets in the mollusks was interpreted as a reminiscence of what occurs in the polyclade, and evidence was given that a similar reminiscence occurs in some annelids (*Aricia*).

In the polyclade the fourth quartet is purely entoblastic; but the posterior cell

divides symmetrically, always (*Discoœclis*?), or occasionally (*Leptoplana*). This cell is probably to be regarded as the prototype of the second somatoblast of annelids and mollusks, which divides symmetrically to form the 'primary mesoblasts,' the mesoblast bands (ento-mesoblast) being a new formation and the ecto-mesoblast ('larval mesenchyme,' etc.) being homologous with the mesoblast of the polyclades. This interpretation is sustained by the fact that the posterior cell of the fourth quartet may contain entoblastic elements largely developed (*Crepidula*), considerably reduced (*Nereis*) or reduced to a pair of rudimentary or vestigial cells (*Aricia, Spio*). The latter strikingly illustrate ancestral reminiscence in cell-lineage, and represent the penultimate stage in a series which begins with the polyclade. These facts and others were urged in support of the cell theory of develment and the value of cell-lineage in the investigation of homologies.

The Characters and Phylogeny of the Amblypoda. H. F. Osborn.

As a result of the recent explorations by the American Museum of Natural History, a complete skeleton of *Coryphodon* has been procured and mounted, as well as a nearly complete skeleton of *Pantolambda*, not only one of the oldest geological, but the most archaic type of ungulate, from a morphological standpoint, hitherto discovered. The restoration of this animal shows it was completely plantigrade, progressing upon the plantar and palmar surfaces of the feet, like a bear. There is an os-centrale carpi as in the *Creodonta*, and the whole skeleton, is strongly impressed with the Creodont type, reinforcing the evidence already derived from the Phenacodontidæ, that the Ungulata sprang from Unguiculate animals. This restoration agrees with a prior restoration of *Periptychus*, and the resemblances between these two skeletons are very marked, supporting the author's views expressed in 1893, that *Periptychus* should be placed among the Amblypoda. This gives this very ancient order of ungulates a very wide functional variation from small arboreal types to the huge *Uintatheres* of the Eocene. The evolution of the skull can now be fully traced out, and in *Coryphodon* we observe the rudiments of the frontal and parietal horns of *Uintatherium*.

A Series of Specimens Illustrating the Development of the Chick. Mrs. S. P. Gage.

These illustrate Professor Gage's idea that in an embryological series for a museum all stages sufficiently different to be easily recognized by the naked eye are to be included, to the adult condition. They are the unincubated germ, the 12, 18, 24, 36, 48, 60, 72 and 96-hour chick; and from this point on to hatching are at intervals of one day, ending with a chick just emerging from the shell at the 21st day. Mounted skins of chicks 24 hours and six days after hatching, of one in the stage known commercially as a broiler and of a hen and rooster complete the series.

All the specimens were fixed in 10 per cent. nitric acid, washed to free from yolk and preserved in alcohol. From the 7th day on, the membranes were too extensive to show both them and the chick, and parallel series were arranged in the same jar, one to exhibit the chick and one the membranes.

The earlier stages were mounted on cover glasses, which had been albumenized and built up in a slightly convex form with collodion and brushed with a coating of collodion containing lamp black. The germ was floated on to the cover under alcohol and fixed in place by thin collodion. Glass strips to fit the jars were prepared by albumenizing and (unless the glass were black) coating with thin collodion containing lamp black, thus giving a strongly con-